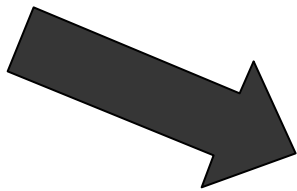# SESSION PAPERS

OVERVIEW & VISION

STANDARD TEST EQUIPMENT PLATFORM (MODULES)

GWTS UPGRADE

COMMON ATS ARCHITECTURE

HARDWARE | **SOFTWARE**

AIRCRAFT INTERFACE EXAMPLE

MISSILE AUR ATS EXAMPLE

Common Test Architecture Development For Munitions Level Test Platforms

John J. Lohse

Raytheon Company

Test Systems Design Center

NDIA

Systems Engineering and Supportability Conference
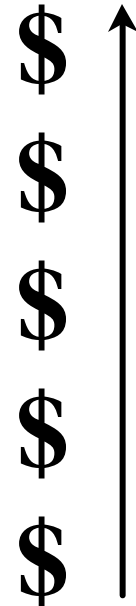
San Diego, CA

25 October 2000

Why The Need?

High Cost of ATE $

Obsolescence $

Minimize TPS Development Effort $

Reduction in Total Test Systems $
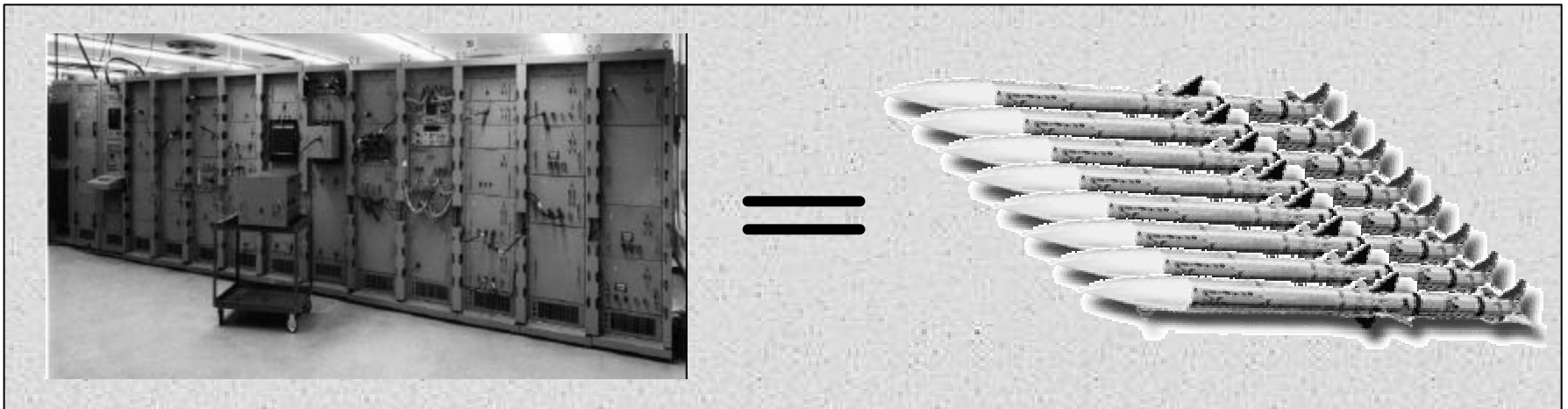
Factory and Depot Testing $

ATE Life Cycle Costs Continue to Escalate

Why The Need?

Customers Want To Buy Missiles

Not Test Equipment!

What's The Solution?

Common Munitions Test Architecture

A Joint Industry/DoD Venture

Modular, Adaptable, Reconfigurable

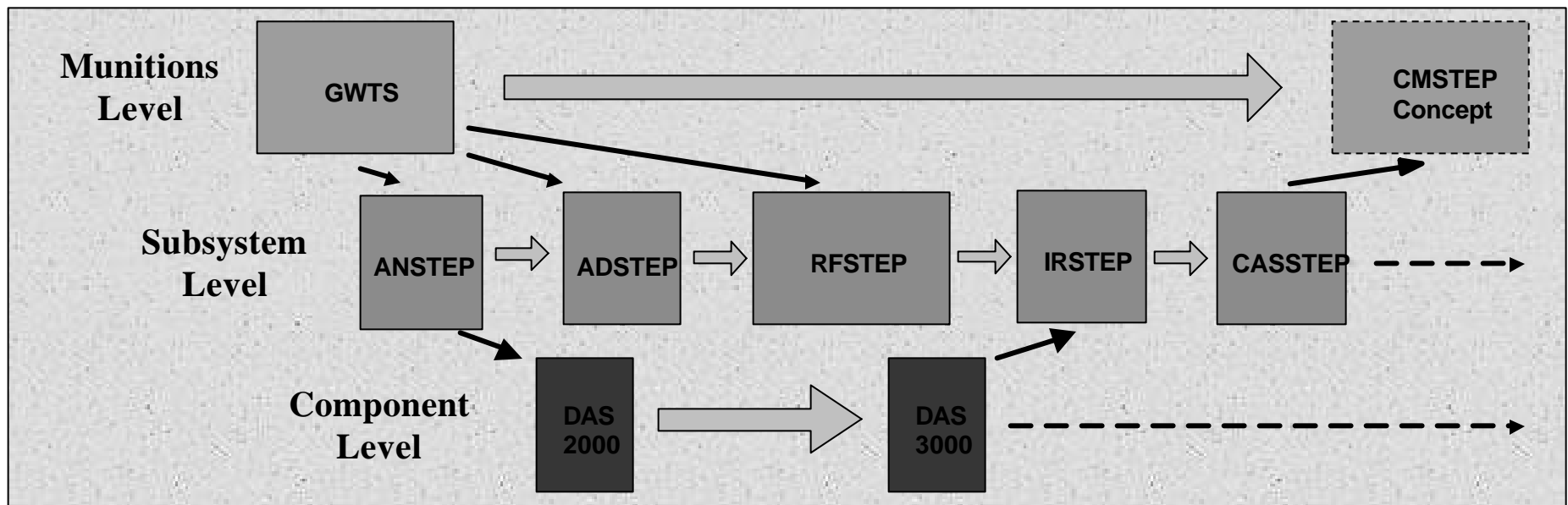**Capabilities Necessary to Manage Obsolescence**

- **COTS Instrumentation and Software**
- **Common Internal and External Interfaces**
- **Layered Software Approach**

Architecture Must Be Capable of Extending into the Operational Test Program Sets

How Do We Get There?

- ## Follow the Roadmap to Success

Common Munitions Test Architecture
(Cornerstone of Evolution)

How Do We Get There?

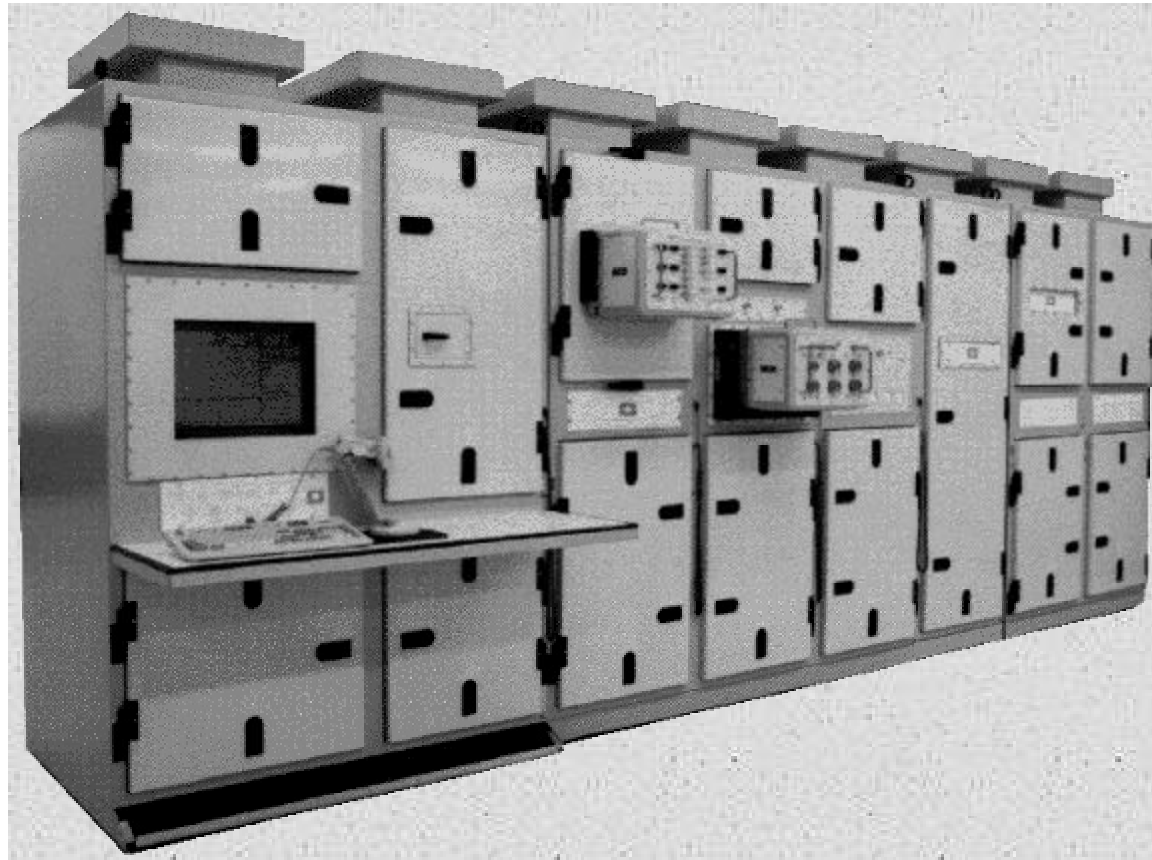- **Evolution of the Common Munitions Test Architecture**
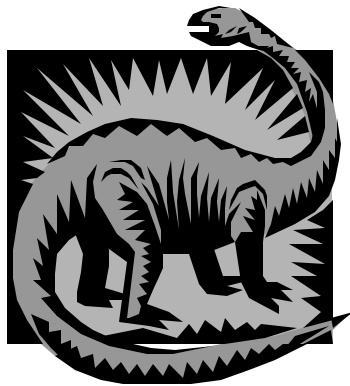
From:

Guided Weapons Test Station

To:

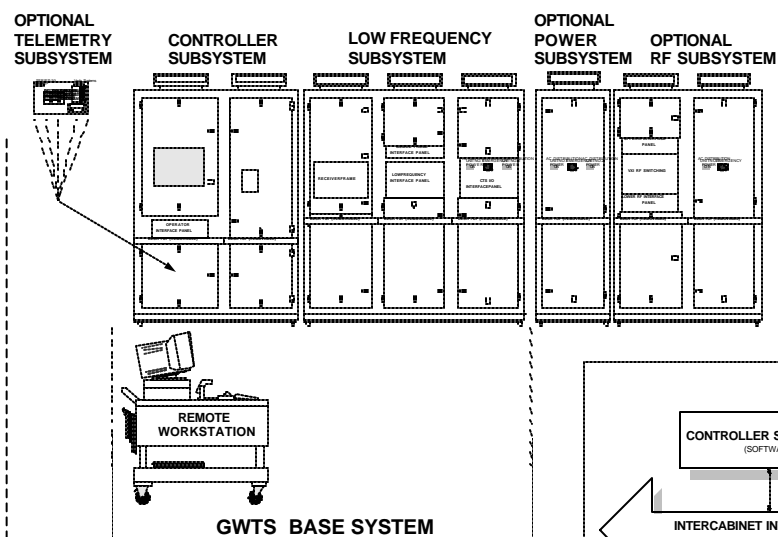**Common Munitions Standard Test Equipment Platform (CMSTEP)**

Raytheon

Guided Weapons Test Station (GWTS)

CMSTEP Concept

Raytheon

COTS Instrumentation and Software

Common Internal and External Interfaces
Backbone Interface

OPTIONAL
TELEMETRY
SUBSYSTEM

CONTROLLER
SUBSYSTEM

LOW FREQUENCY
SUBSYSTEM

OPTIONAL
POWER
SUBSYSTEM

OPTIONAL
RF SUBSYSTEM

REMOTE
WORKSTATION

GWTS BASE SYSTEM

CTS I/O
INTERFACE

GUIDED PROBE
INTERFACE

LF
INTERFACE

CONTROLLER SUBSYSTEM
(SOFTWARE)

LF
SUBSYSTEM

EXTERNAL
SYSTEM
INTERFACE
AND
EXTERNAL
STAND-BY
AC POWER
INTERFACE

INTERCABINET INTERFACE (IEEE-802.3, HSD, AC POWER CONTROL, STAND-BY AC POWER)
SUBSYSTEM I/O INTERFACE

POWER
SUBSYSTEM

TELEMETRY
SUBSYSTEM

RF
SUBSYSTEM

OTHER
SUBSYSTEM

RF
INTERFACE

Layered Software Approach
CMSTEP Concept

Evolution to CMSTEP

CMSTEP Concept

- ## CMSTEP Conceptual Design
  - ### – Basic hardware, software, and maintenance building blocks which mirror one another

Hardware →

Software →

Maintenance →

CMSTEP

Subsystem 1

Subsystem x

Subsystem N

Instrument A

Instrument B

Instrument C
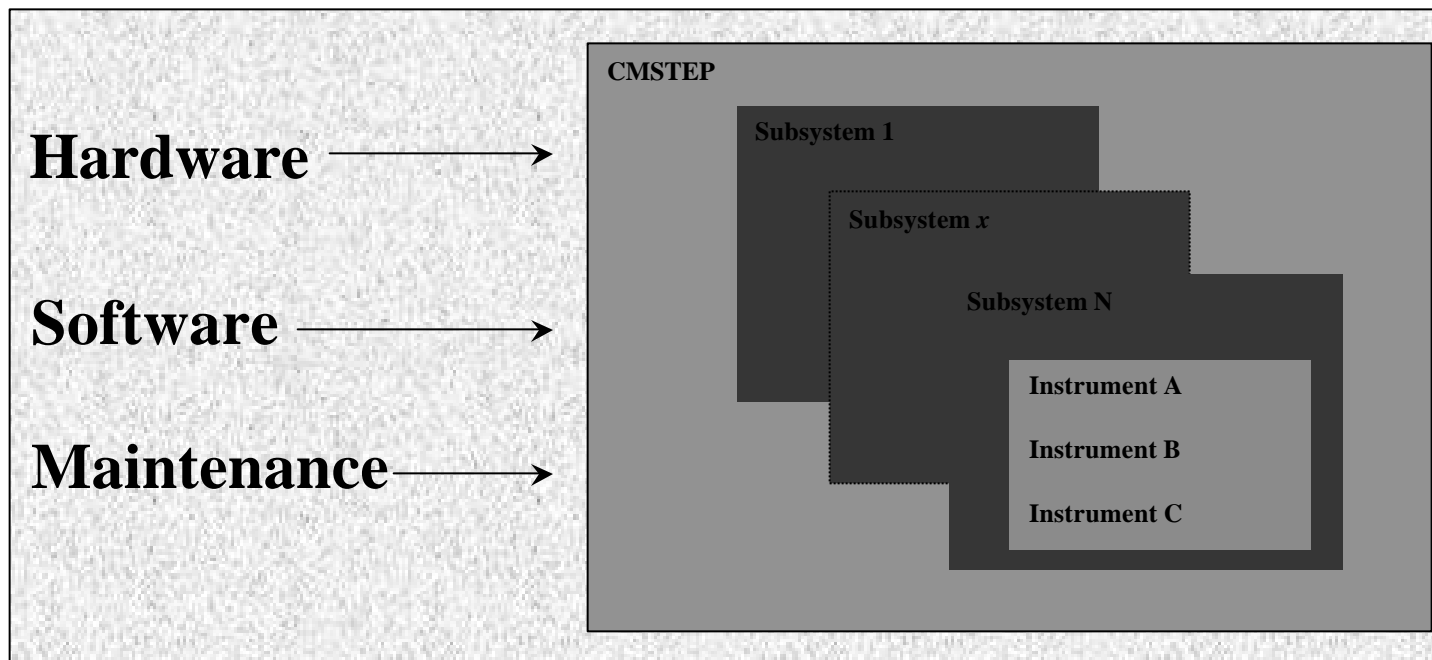
CMSTEP Concept

- # CMSTEP Conceptual Design

    ## *"Disciplined Flexibility"*

    ### Hardware Based on RF STEP CM Approach

    - Optional Blocks of Capability Based on Cost

    ### Software Based on GWTS and IRSTEP Layered Approach

    - Flexibility Requires A More Structured Design

    ### Maintenance Based on GWTS Lessons Learned

    - Designed to Match the User's Needs

CMSTEP Concept

- ## CMSTEP Hardware Conceptual Design
  - ### Backbone Interface
  - ### COTS VXI Instrumentation
  - ### Subsystem Enhancements and Options
    - Controller Subsystem - PC based enhanced controller
    - Low Frequency Subsystem - digital and switching options
    - Power Subsystem - munition specific capability
    - RF Subsystem - multiple channel and phase noise options
    - Add multiple test cell capability

CMSTEP Concept

Raytheon

- ## Backbone Interface
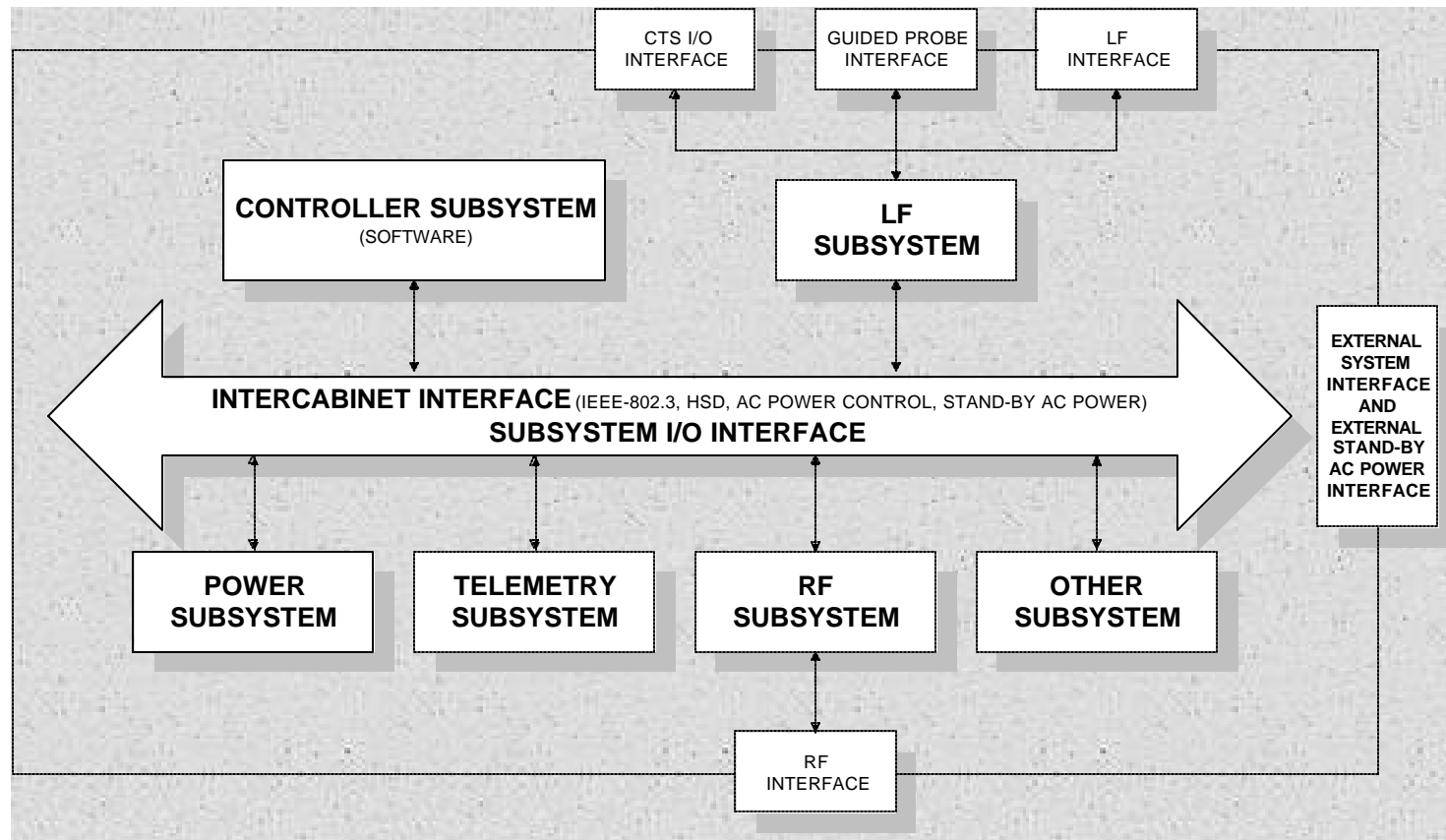
CMSTEP Concept

• **Current Single Cell Depot Layout**

Control Room

Test Cell

Backbone Interface

CMSTEP Concept

•CMSTEP Multi-Munition Depot Layout

Control Room
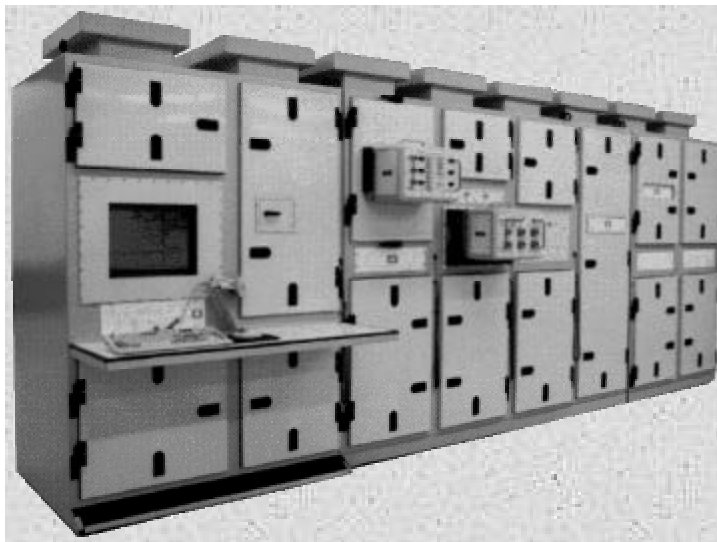
Backbone Interface

Test Cell 1

Test Cell 2

Test Cell N
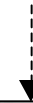
CMSTEP Concept

- ## CMSTEP Software Conceptual Design
  - ### Layered Software Approach
    - Application Program Interface (API)
      - » Critical Software Interface to Manage Obsolescence of COTS Instrumentation
    - Relationship Between Hardware and Software Modules are Tightly Coupled
    - Significant Amount of Software Code Re-use
      - » Standard User Interfaces
      - » Program Services
      - » Feature Sets

CMSTEP Concept

Raytheon

- ## Software Layered Approach

Executive

$\updownarrow$

Application Program Interface (API)					
DigitalMultimeter	Switch Matrix	Analyzer	GS Computer	Power Meter	RF Signal Generator

$\updownarrow$ $\updownarrow$ $\updownarrow$ $\updownarrow$ $\updownarrow$ $\updownarrow$

DMM HP E1410	ASCOR 3000-39	TKTVS 646	PC 486	GIG 58542	HP 8643A

Test System Software
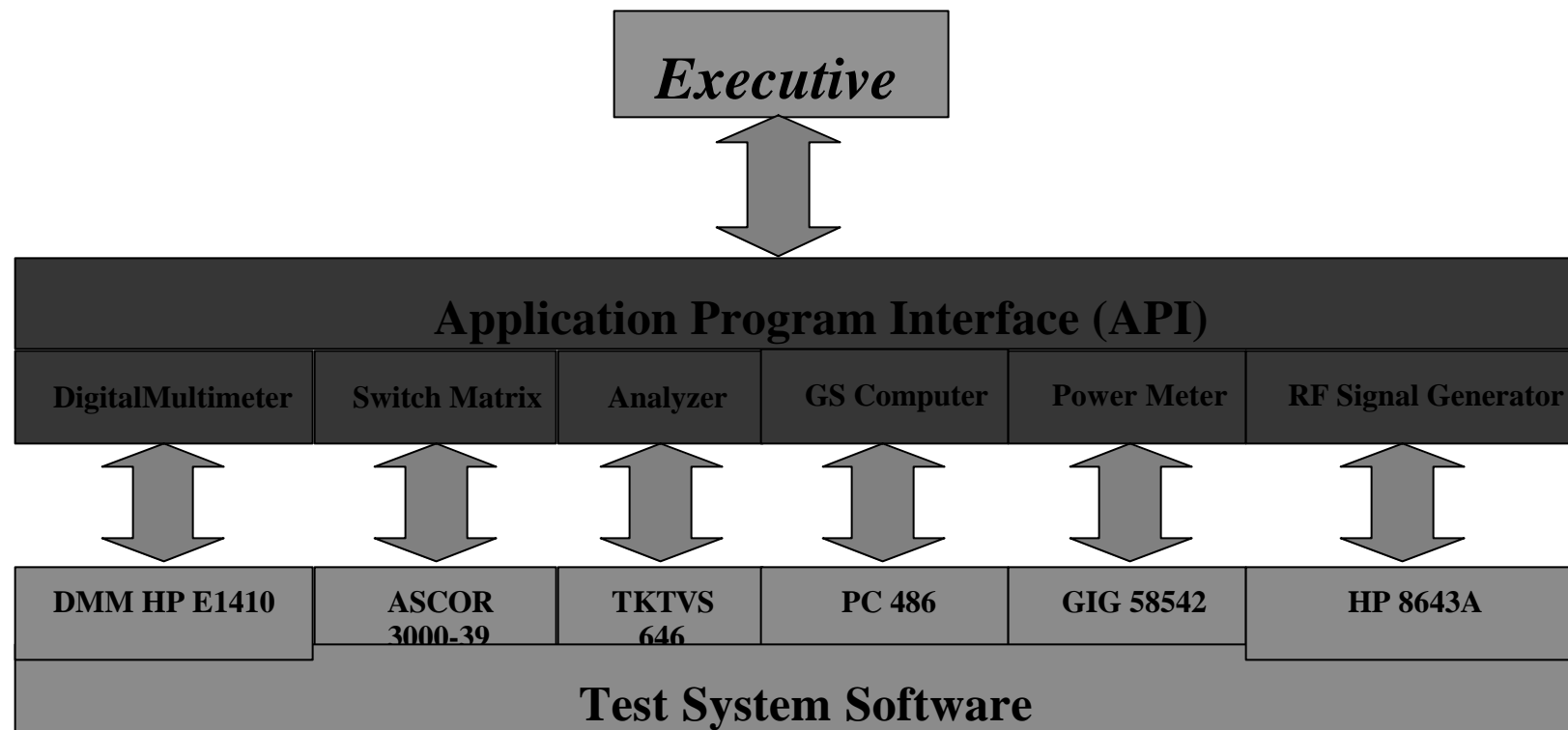
CMSTEP Concept

- # CMSTEP Maintenance Conceptual Design
  - ## Self-test
    - – Ascertain the Health Status of the CMSTEP
    - – Comprehensive CMSTEP Diagnostics and Repair Verification
    - – TPS Self-test Used to Confirm Daily Station Readiness
  - ## Calibration
    - – Provide Calibration of Assets Required for TPS Certification (Remove & Replace Calibration)
    - – TPS Calibration Verifies System Level Performance

CMSTEP Concept

Raytheon

- ## CMSTEP Diagnostics and Repair Verification

```
┌──────────┐     ┌──────────┐     ┌──────────┐
│ Station  │     │ Verify   │     │ CMSTEP   │
│ Failure  │ --> │ TPS is   │ --> │ Self-test│
│ Occurs   │     │ Good     │     │Diagnostics│
└──────────┘     └──────────┘     └──────────┘
                                        │
                                        v
                 ┌──────────┐     ┌──────────┐     ┌──────────────┐
                 │ Replace  │     │Verify Fix w/│   │Cal Instrument│
                 │ Failed   │ --> │ CMSTEP   │ --> │w/ CMSTEP     │
                 │Instrument│     │ Self-test│     │Calibration   │
                 └──────────┘     └──────────┘     └──────────────┘
```

Conclusion

- **A Common Munitions Test Architecture is the Solution to Escalating ATE Costs**

- **Joint Industry/DoD Cooperation Strengthens Test Architecture Evolution**

- **Today's Architecture Must Evolve to Include and/or Enhance:**

  - **COTS Instrumentation and Software**
  - **Common Internal and External Interfaces**
  - **Layered Software Approach**
  - **Cost Effective "Managed Flexibility"**